New Jersey GIS Update

A newsletter about NJDEP 's Geographic Information System

Issue #34 Spring 1998

1:24000 DEM files enhance GIS modeling & display capabilities

As part of the 1995/97 digital imagery project, the GIS unit will soon be receiving all of the DEMs used by the USGS in the production of the digital ortho-quarterquads. What is a DEM, and why do we want them?

DEM stands for Digital Elevation Model. Each DEM is a file containing elevation data at selected points across a quadrangle map tile. The file, then, contains x, y and z values for each point sampled in real world coordinates.

DEMs are an integral part of the digital ortho-quarterquad (DOQ) production process. The elevation data are used to remove terrain relief displacement in the photo being scanned and converted to a digital product. Without the elevation data, the digital image could not be produced to meet the necessary map accuracy specifications for quarterquad image files.

Aside from their use in the DOQ production process, DEMs are useful in many other applications. Many modeling programs examining surface flows and movements, contour generation, line of site determinations, slope calculations, etc., require elevation models. Several analyses using DEMs, in fact, can now be done right in ARCVIEW through the Spatial Analyst Extension. So the availability of the DEMs should open up some new avenues of investigation for DEP GIS users.

The DEMs we have received to date, and others we will be receiving in the near future, are all 7.5 minute DEMs using 30x30 meter point spacing, cast on the UTM projection. The 30 meter spacing means that a grid with 30 meter cells is generated for each topoquad tile, and elevation values are taken from the source topoquad elevation coverage at each grid line intersection. The UTM files are being projected to New Jersey State Plane Coordinates (NJSPC), by first creating a lattice from the DEM and then projecting this lattice to NJSPC.

Contours are also being created for each one of these projected lattices, through the ArcView Spatial Analyst extension. The contours will be stored as individual shape files for each topoquad map tile, with contour intervals of 10 feet. While the contours can be quickly generated on the fly in Spatial Analyst, the extension is not yet available to everyone on the DEP GIS network. As a shape file, the contours

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Non-profit GIS user community strengthened by URWA initiative

Editors Note: This is the first of a three part series describing the status and goals of the non-profit GIS user community in New Jersey. We are grateful to Doug Schleifer of the Upper Raritan Watershed Association for submiiting this article.

Numerous non-profit organizations have established or are seeking to establish GIS systems. Many of them have made a commitment of resources to using GIS while other organizations have not been able to for a variety of reasons. The New Jersey Non-Profit Community (NGC), the GIS users group established by the Upper Raritan Watershed Association (URWA) in 1996 with a grant from the Victoria Foundation, has been a substantial help to the many organizations which have committed to GIS use. It is the purpose of the NGC to provide facilities and support to those organizations able to exploit the power of GIS technology. It is also the purpose of the NGC to provide structure to encourage those organizations that have been relatively inactive or reticent about implementing GIS.

This includes an interactive network of GIS users to facilitate joint problem solving, access to technical information, use of facilities, training and consulting. The results have been, and will be for those who have not yet made the commitment, more effective environmental decision making statewide, enhanced effectiveness for individual organizations and greater cooperation among group members.

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DEMs

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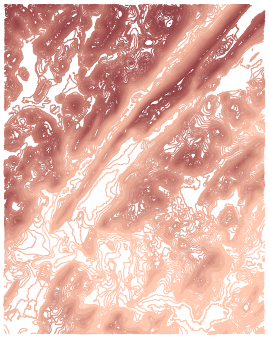
generated through Spatial Analyst, however, can be added to and queried in any ArcView project.

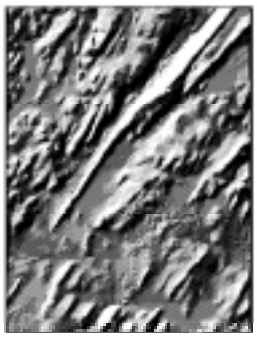
At the present time, the DEM data sets will be posted as individual topoquad based layers. When all the available DEMs are received and projected, the plan is to create area wide DEM and contour layers, based on county or watershed tiles. This, however, will require some additional data processing since edge matching between DEMs and the generated contour layers may not be complete. Until then, GIS users will have to rely on the 7.5 minute tiles, or do their own additional processing to generate multi-tile elevation models or contour coverages.

One point to note is that the contour shape files created through Spatial Analyst from the projected lattices do not have the smooth shape of the digital line graph (DLG) contour coverages, represented by the contours on a typical topoquad sheet. This is because the contour lines in ArcView are being generated from raster files with lines created by linking the center points of indivual grid cells having the same elevation values. While these contour data are still very helpful for analysing area charteristics, we will be reviewing ways to generate smoother contour coverages from the DEM data in the future. For those interested in the production and accuracy specifications of the original DEMs, you can go to the following USGS web site location: http://mapping.usgs.gov/www/html/2nmpqds.html. Specifications for the DEMs and for other USGS products can be accessed from this location

Submitted by John Tyrawski, BGIA.

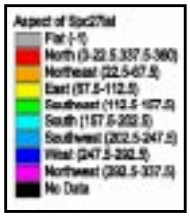


contours



hillshade

DEMs can be used in various applications requiring elevation data. Shown above are ten foot contours for the Dover quadrangle. Using Spatial Analyst, hillshades are easily created as well as aspect and slope themes.



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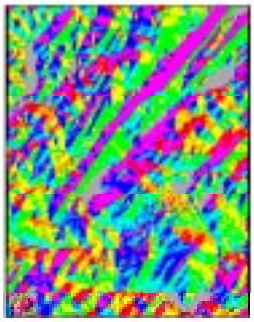

Non-profit

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Environmental protection is a multi-faceted process which involves individual landowners, land users, citizen's groups, all levels of government and non-profit organizations. This process requires that environmental information be available in a useable form to decision-makers and other involved parties. Decisions are often made without reference to available information. This is particularly true of geographic information.

The use of computerized systems for conducting geographic analyses is rapidly becoming a preferred method in the practice of environmental planning and management. Recent developments in computer hardware, software and data have created potentially vast opportunities for non-profit environmental organizations and lower levels of government in the areas of land preservation, agricultural preservation, wildlife management, master plan development, ordinance development, site plan review, water resources protection and management and recreational planning.

As personal computers have become more powerful and less expensive, computer software has become more powerful and user friendly. Environmental Systems Research Institute (ESRI) has donated 500 copies of their Geographic Information Systems (GIS) software, ArcView, to non-profit organizations, environmental commissions and libraries in New Jersey. Thus, an opportunity exists to develop the use of this technology for use by non-profit organizations. This opportunity, of potential benefit to the whole state, should be utilized to its fullest.

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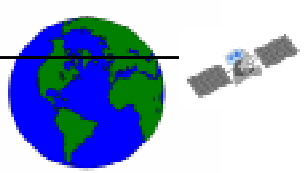

Critical Collection Parameters Key to Quality GPS Data (Part 2)

Given that GPS can now be viewed as a mainstream technique for GIS data collection, it is appropriate to discuss some of the critical GPS receiver collection parameters. In this series of articles, beginning in the last issue, several critical receiver settings are discussed which greatly impact the quality (accuracy) of locations of features collected using GPS. These settings are critical because if these parameters are set inappropriately, there is a good possibility that locational data collected may be suspect or unusable. It is the intent of these articles to help provide conceptual understanding on these topics for experienced and novice GPS users alike, and to emphasize their importance for quality GPS/GIS data collection.

The parameters that we discussed in the last issue were: position fix mode, positional dilution of precision (PDOP) mask, and elevation mask. In this issue we will continue with signal to noise ratio (SNR) mask, minimum number of stored fixes for point features, and logging intervals. As mentioned in the first article, these parameter settings, which all users of GPS should be familiar with and fully understand, significantly impact the quality of collected geographic coordinates. It is highly recommended as a standard practice that these settings be checked by the GPS operator before the logging of position fixes begins. This is especially so if the receiver is used by more than one individual in an organization. In the next issue's article (the last in this series) differential correction methods will be discussed.

The **signal to noise (SNR) mask** is set in the GPS receiver to restrict the receiver from using weak GPS signals for position fix calculations. Signals with SNR values below a critical threshold (the value of the mask) will not be used. The higher you raise this mask for the receiver, the further you restrict the receiver to use only strong GPS signals.

Under open sky conditions, GPS signals coming from satellites directly overhead are normally the strongest (having high values for SNR). As satellites move closer toward the horizon their signal strengths weaken (the signal becomes noisy). The most common environmental condition that lowers a signal's SNR is tree canopy. Very dense tree canopy can make GPS work difficult or impossible, due to the weakening of GPS signal strength. The normal setting for this parameter is 4 for Trimble GeoExplorers, or 6 for Trimble Pro XR, Pro XL, older Pros, and Basic Plus. By setting the SNR mask to this threshold, you reduce the chances that your position fix calculations will be negatively impacted by these weaker, less reliable signals.

Recall that we need to be able to receive GPS signals from at least four satellites (with good satellite geometry) simultaneously for the receiver to determine a position fix. If we can't get four satellites, each with sufficient signal strength, the receiver will not be able to calculate fixes for the position. As a rule, the more costly receivers with advanced signal processing capabilities perform better under adverse conditions. Using an external antenna on a range or prism pole can greatly enhance the receiver's ability to acquire a stronger signal.

Point feature collection (i.e., wells, discharge points, etc.) requires that a minimum number of position fixes be collected for each feature. This number represents the number of sample position fixes that will be taken for a particular feature. This number is somewhat receiver dependent. With Trimble GeoExplorers, Basic Plus, and older Pro receivers, 200 fixes is NJDEP's recommended setting. With Trimble Pro XLs and Pro XRs, 60 fixes are recommended. These numbers exceed the values recommended by the manufacturer, and a good reason for doing this is that it provides some flexibility for editing (removing) fixes later on during the GPS data analysis phase.

Generally, not much additional accuracy is gained by collecting more fixes than the recommended minimum, though some users maintain that additional fixes can improve z (elevation) accuracy. The Pro XRs, Pro XLs, and GeoExplorers also provide a High Accuracy collection mode, which requires an uninterrupted 10 minute (minimum) collection period for each feature, yielding submeter accuracies under the right conditions. With line and polygon features the minimum number of position fixes doesn't apply. The minimum number of fixes in these two cases would be however many are needed to adequately define the line or polygon.

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Update on Extensions

ArcView extensions are add-on programs that allow you to enhance your ArcView graphical user interface with additional buttons, tools and menus that can be easily loaded and unloaded in your project. Load an extension by selecting "Extensions" from the ArcView project window file menu. The following ArcView extensions were either developed in-house or downloaded off the web and are available to DEP GIS users. To access these extensions the *USEREXT* variable must be set to the /develop/av30/ext directory. For complete instructions on accessing these and other extensions see the Summer 1997 issue (#32) of the *NJ GIS Update* or stop by or call (609-777-0672) the GIS Help Desk on the 1st floor of the DEP building.

Add ID Numbers Adds idnum field to active table and numbers sequentially

Add xy coordinates to theme table Adds two new fields, named X-coord and Y-coord, to the table of the first active theme in the TOC and fills the respective fields with the X,Y coordinates of the selected points or centroids (or all points/centroids if no selection is defined).

ArcTools Analysis Menu ArcTools Analysis Menu provides a suite of analysis tools similar to Arc/Info commands: buffer, clip, dissolve, distance, eliminate, erasecover,explode,identify,intersect, mapjoin, near, split, union, update. (See Xtools extension also)

Cadtools This extension provides tools for working with CAD drawings

Calculate Area,Perimeter or Length Creates an area & perimeter or length field and calculates (or updates) values in table(s) of activated theme(s)

Calculate Point Distance Calculates distances from points in one theme to points in another

ClipRing (Population/Wetlands) Clips coverages and sums population or wetlands acres by distance from a specified point

Coordinate Converter Converts coordinates in a database from lat/lon, UTM or State Plane

Convert lat/lon file to state plane shapefile Converts a table with latitude and longitude values to a state plane shape file and carries the attributes over. Table must have six fields for latitude and longitude.

Environment Variables Check Check the state and path of NJGIS Environment Variables. It will check for correct path locations and allow users to change path settings within an Arcview session

Extension Builder Example This extension installs 3 scripts to help in building your own extensions.

Facility Locator This extension will help locate a facility by zooming to the facility coordinates (latlon,UTM or state plane), or zoom to a facility address (using address matching) or zoom to municipality. There is an option to pull in the topoquad or quarter quad images to aid in determining the correct facility location. (Requires Dialog Designer)

GPS Converter and Shifter Converts .gml file to theme; Converts .pts, .lin, .ply files to theme; Shifts point(s) specified angle and distance

GRID Cross Section Tool Allows cross sections to be indicated on a View and drawn as a frame on a Layout

Latitude/Longitude Retriever Displays latitude and longitude in a MsgBox after User selects tool and clicks on desired area of state plane view

Labeling - Contains tools for labeling and adding text to views and layouts

OverView Window Allows you to create overview windows for views

Projector Allows conversion of data between map projections

Random Point Generator Generates user defined number of random points in a selected polygon

Save Documents to an ODB File Save/Restore ArcView Objects to/from ODB files

Script-Recovery Load Scripts from other projects or extensions without having to open or import them

Shapefile to DXF file Converter Converts a shape file to an autocad dxf file

Table Merger Merges two table with same fields in same order together to create new output table

Theme Selector Lists available themes, displays data dictionary for selected theme, prompts to add the theme and supplies a theme name

Virtual Doc Utilities Provides utilities for working with virtual documents such as associating Docs with DocGUIs and grouping Docs on the project window

Warp Environment An environment for the Spatial Analyst for georeferencing grids

XTools This extension contains useful tools such as buffer, clip, erase, identity, intersect, merge, union, update, shape to graphic converter, etc. (See ArcTools Analysis Menu extension also)

Zoom to Lat/Lon Coordinate Zooms to a user-input lat\lon coordinate and places a marker at that location.

Zoom to Municipality Zooms into municipality selected from a list

Zoom to Quad Zooms to UGSG Quadrangle selected from a list

UpClose.....*but not too personal*

This issue of **Upclose... *but not too personal*** *highlights the GIS staff from the Office of Information Resources Management. The staff provides guidance and assistance to the various bureaus within DEP as well as outside agencies. If you have questions about the GIS give us a call, either at the main number (609-984-2243) or the GIS Help Desk (609 777-0672.)*

Hank Garie has directed the NJDEP GIS Program since 1986, and has seen it grow from a research project to an enterprise wide decision support tool. In addition to convincing others in DEP that GIS is an indispensable information integrator for environmental management, Hank is actively encouraging statewide coordination of GIS as Chair of the State Mapping Advisory Committee. He is also a New Jersey representative on national GIS issues serving on the Mapping Sciences Committee of the National Research Council, and as the Past President of the National States Geographic Information Council.

Back row (from left): Angela Witcher,John Tyrawski,Diana Keck,Hank Garie,Paul Anderson,John Fleming
Front row (from left): Bill Guthe,Larry Thornton,Pat Cummens,Lou Jacoby,Barbara Plunkett

Pat Cummens is the manager of the Bureau of Geographic Information and Analysis and has been with DEP since 1987. In addition to handling management and budget issues, Pat is involved in efforts to promote and coordinate GIS statewide. She also serves on an EPA advisory committee which looks at GIS data issues on a national level.

Paul Anderson, a DEP employee since 1991, recently joined the BGIA bringing a strong background in both GIS and programming. Paul has been using his skills to develop customized extensions for a number of DEP bureaus. In addition, he has been developing GIS application for the internet using JAVA, MapObjects, and the ArcView Internet Map Server.

John Fleming joined the BGIA in 1988 and is co-system administrator of the GIS network. John researches the latest GIS hardware and software developments, and provides hardware and software technical support to DEP and the county GIS users. John also coordinates the DEP web site developers group.

Bill Guthe has used GIS technology since 1984, and joined the BGIA in 1991. Most recently, he has concentrated on customizing ESRI's ArcView software to support various NJDEP programs, using Avenue scripts and ArcView extensions to meet program needs. He is also involved in database management, systems administration, and training.

Diana Keck is co-system administrator of DEP's GIS SUN network. Her responsibilities include providing hardware and software technical support to DEP and the county GIS users, managing hardware and software maintenance contracts, system monitoring, system backups, Avenue project development, and general user support She has been with the BGIA since 1981.

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Non-profit

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In anticipation of these developments, URWA has taken a leadership position within the non-profit community in use, development and promotion of this technology. Having obtained funding from the Victoria Foundation to implement NGC, URWA has acquired the necessary computer hardware and GIS software to create a GIS computer network within its offices.

These facilities are capable of supporting a full range of analyses, data development and map making functions. Hardware includes a computer workstation, two PCs, digitizing table, plotter, printer, scanner and global positioning system. Software includes ARC/Info, ArcView, ArcView Spatial Analyst, ArcView Network Analyst and GRASS. The selection of GIS software allows full compatibility with nearly all commercial government and institutional data providers.

The fact that URWA was first among New Jersey non-profits to place a GIS Specialist on staff allowed URWA to be the first to collaborate with and/or provide GIS services to government agencies, citizen groups, academia and other non-profit organizations. Relationships have been developed and maintained with all of these entities.

A broad range of practical experience has been gained by providing analyses ranging from groundwater recharge estimation to development suitability. Importantly, this experience has involved not only technical issues, but also issues relating to policy development. This experience makes URWA the ideal candidate to provide advice and support to other non-profits implementing GIS. Demand for these services are increasing dramatically.

Objectives

* To build upon a successful effort to provide technical and conceptual support and facilities to environmentally oriented non-profit organization operating in New Jersey.

* To promote literacy in the use of GIS technology in the environmental community.

* To take a leadership role in coordinating GIS use and data development among the larger GIS community.

* To provide a forum for interaction leading to data sharing and project collaborations among non-profit organizations.

* To promote the activities of the NGC in a wider forum, including conferences, meetings and the internet.

Part 2 will be continued in the next issue of the NJ GIS Update

Upclose ...

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Lou Jacoby began working in DEP in 1984 in the Division of Water Resources providing GIS support and acting as GIS coordinator for the Division. He moved to the BGIA in 1991 and has been serving as the Department's Global Positioning System coordinator and instructor. Lou has also been managing the DIFF/Masterfile site location collection GPS project.

Barbara Plunkett joined the DEP and the BGIA in 1987. Barbara's primary duties focus on customizing applications for the casual GIS user. She is also involved in the GIS training program and is editor of the Department's quarterly GIS newsletter, the *NJ GIS Update*.

Larry Thornton manages GIS data development projects including the 1995 aerial photo and digital imagery project, the update of land use/land cover from 1986 to 1995, and the production of data distribution CD-ROMS.

John Tyrawski has been with DEP for 18 years and with the BGIA for 6 of those years. John's background is in biology and coastal wetlands and he also has several years experience in cartography and air photo interpretation. Most of John's time is spent on several ongoing GIS data development projects: 1995 digital orthophotography conversion; 1986 to 1995 landuse/landcover update: oil spill applications; and freshwater wetlands.

Angela Witcher is the Department's GIS training coordinator. In addition to scheduling and teaching GIS courses at DEP, Angela also develops the course curricula. Two new courses were recently added - *Integrating CAD Drawings with ArcView* and *Digitizing and Editing in ArcView.* She is currently developing a course which addresses cartographic and communication issues in map design. With the Department since 1988, Angela has been involved with a number of data development projects including the Department Integrated Facility File, the Toxic Release Inventory and the Known Contaminated Site List.

Critical Collection Parameters

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Position fix logging intervals may be set by the user depending on the type of feature the user is trying to capture. The logging interval is the frequency at which the receiver stores or logs position fixes to a file. The interval is usually set for a time interval (1 fix per second), but can also be set for a distance interval (1 fix per 10 feet distance traveled). For point feature positioning, Trimble GPS receivers can use the 'All' option for this parameter setting to collect the minimum number of fixes in the shortest amount of time. This will allow the receiver to log fixes as fast as the receiver can determine them (about 1 every 7/10ths of a second). Receivers that don't offer the 'All' option, should be set to a one second interval.

Something to note: Trimble recommends in their operation manuals that logging intervals match the logging interval of the base station whose data will be used for differential correction. In this way, there is synchronicity between field data and base data on a fix by fix basis. All of the Trimble community base stations in our area log measurements at a 5 second interval. Tests have revealed no evidence to support the idea that the field receiver's interval needs to be consistent with the base station's interval. A minute's worth of field data logged with a Pro XR using a 5 second interval for 12 fixes should result in similar accuracy as when using a 1 second interval for 60 fixes. Using a GeoExplorer, a 5 second interval for 40 fixes should result similar accuracy as when using a 1 second interval for 200 seconds. Trimble has confirmed these findings to be true. I personally favor having more fixes stored for point features and opt for the 1 second interval or 'All' option.

The default setting for line and polygon features is a 5 second logging interval. Logging intervals for line and polygon features can be modified according to several considerations. Since the user will be moving with the receiver, the speed at which the receiver will be moving is a consideration. A user that is mapping a park trail by walking the trail covers a very short distance in 5 seconds compared to if he was driving a vehicle. If walking a trail or other relatively straight path a 10 second interval may suffice. If logging data while driving a vehicle on a winding road, perhaps a 1 second interval (1 second = 44 ft at 30 mph) would be more suitable. When working with medium to larger intervals (5 seconds or more), it is a good idea to pause at inflection points along the trail to be sure that a GPS fix is logged at that location. This eliminates these features from having "cut corners". When mapping a trail under tree cover, it is usually better to switch to a 1 second interval. This can reduce the number of gaps between points due to signal blockage.

Submitted by Lou Jacoby, BGIA

Questions about DEP's GIS?

Call the GIS Help Desk at 777-0672

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URISA/SMAC Workshops offered

The Mid-Atlantic Chapter of URISA and the New Jersey State Mapping Advisory Committee are joining forces to offer two days of GIS workshops for current and potential users of GIS technology. The workshops will be held June 11-12, 1998 at the Civic Square Building at Rutgers University. All workshops are from 8:30 to 4:30 unless otherwise noted below. The full-day fee is $55 and the half-day fee is $35. Morning coffee and afternoon snacks are included. Workshops offered are:

Introduction to GIS (offered twice, June 11 & 12)

Parcel Mapping with GIS (offered twice, June 11 & 12)

Address and GIS: Issues and Applications (June 11)

GIS for Decision Makers (June 11)

Introduction to Global Positioning Systems (June 11)

Managing GIS Projects (June 12)

Municipal GIS Application (half-day, 8:30-12:00, June 12)

Introduction to Geodetic Control (half-day, 1:00-4:30, June 12)

For program information contact Jim VanOstenbridge at (215) 283-6988 or Hank Garie at (609) 984-2243. For registration information and credit card registration contact Rutgers Program Coordinator at (732) 932-9271 or visit the Mid-Atlantic Chapter of URISA homepage at http://quantifactus.wcupa.edu/macurisa

GIS Events

URISA/SMAC 8th Annual Meeting Workshops
June 11-12, 1998 in New Brunswick, New Jersey
A full suite of GIS courses are offered for current and potential users of GIS technology. See information on page 7

18th Annual ESRI User Conference
July 27-31, 1998 in San Diego, California
Billed as the largest GIS event in the world, the 1998 ESRI conference will be held in the San Diego Convention Center and Marriot Marina Hotel. Hundreds of technical and topical sessions will be offered along with vendor exhibits, a chance to talk with ESRI staff and meet with GIS users from around the world. For information visit the ESRI home page www.esri.com or call ESRI at 909-793-2853.

In This Issue....

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